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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/744,701	01/29/2001	Toru Tatsumi	NECW 18.281	3273

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EXAMINER	
TSAI, H JEY	

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 10/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/744,701	TATSUMI ET AL.	
	Examiner	Art Unit	
	H.Jey Tsai	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 August 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *47-56 and 118-121* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *47-56, 118-121* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

In light of telephone interview on Oct. 10, 2006, the last office action is withdrawn.

Claim Objections

Claim 50 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Because claim 47 includes nitrogen dioxide.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 47-52 and 118-120 are rejected under 35 U.S.C. § 102(b) as being anticipated by Ui et al., 5,976,992, newly cited.

Ui et al. discloses a method of forming a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

introducing metal organic material through, inlet 11 and **oxidizing gas** NO_2 or ozone (O_3) or oxygen through 10b into vacuum chamber of separate introduction inlets, see fig. 2-21, col. 14, Lines 15-67, col. 18, lines 18-21,

heating the substrate (250-350°C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr ($1X10^{-3}$ torr – 2 torr at reaction chamber and reaction zone can be at preferred range 0.01 torr – 1 torr, col. 9, lines 51-55, such as reaction zone 63 at 0.01 torr, see col. 15, line20), col. 4, lines 43-46, (meeting claims 47, 119, 120),

claims 48-49, heating the substrate (250-350°C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr ($1X10^{-3}$ torr – 2 torr at reaction chamber and reaction zone can be at preferred range 0.01 torr – 1 torr, col. 9, lines 51-55, such as reaction zone 63 at 0.01 torr, see col. 15, line 20), col. 4, lines 43-46,

claim 50, oxidizing gas is NO_2 or ozone (O_3), col. 14, Lines 15-67, col. 18, lines 18-21,

claim 51, wherein the film formation is carried out by controlling the gas supply conditions for the organometal gases and/or the oxidizing gas to be self-controlling gas supply conditions (introducing oxygen gas first then organometal gases with separate introduction inlets) as to obtain the metal oxide dielectric film having a prescribed composition and crystal structure, see abstract,

claims 52, 118, wherein the flow rates of organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber, figs. 2-21.

Claims 47-52 and 118-120 are rejected under 35 U.S.C. § 102(e) as being anticipated by Allman et al. 6,211,096, newly cited.

Allman et al. discloses a method of forming a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

introducing metal organic material through, inlet 17, 19, 21 and **oxidizing gas** NO_2 or oxygen through one of inlets 17, 19 or 21 into vacuum chamber of separate introduction inlets, see fig. 1, col. 6, lines 1-67, col. 7, lines 1-5,

heating the substrate (100-900 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr (10 microTorr – 1 atm for deposition condition at reaction chamber after introducing source and oxidizing gases), see col. 6, line 60-67, col. 7, lines 1-5, (meeting claims 47, 119, 120),

claims 48, 49, heating the substrate (100-900 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr (10 microtorr for deposition condition at reaction chamber after introducing source and oxidizing gases), see col. 6, line 55-63, (meeting claims 47, 119, 120),

claim 50, oxidizing gas is NO_2 , col. 6, lines 1-67, col. 7, lines 1-5,

claim 51, wherein the film formation is carried out by controlling the gas supply conditions for the organometal gases and/or the oxidizing gas to be self-controlling gas supply conditions (introducing oxygen gas first then organometal gases with separate introduction inlets) as to obtain the metal oxide dielectric film having a prescribed composition and crystal structure, see abstract,

claims 52, 118, 119, wherein the flow rates of organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber, fig. 1.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 47-50, 51-54 and 118-120 are rejected under 35 U.S.C 103 as being unpatentable over Fujii et al. 5,006,363, previously cited, in view of Ui et al. 5.976,992, newly cited.

Fujii et al. discloses a method of forming a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

introducing metal organic material ($Sr(DPM)_2$ and $Ti(OC_3H_7)_4$, inlets 28-29) and oxidizing gas (oxygen, inlet 25, cylinder 10 at fig. 1) into vacuum chamber through separate introduction inlets, see fig. 1, 2, col. 7, lines 10-30, col. 4, lines 30-35,

heating the substrate (180 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr ($5.7X10^{-4}$ torr through out the period of the film deposition), col. 7, lines 10-30,

claims 48, 49, heating the substrate (180 °C) in the vacuum chamber,

claim 51, wherein the film formation is carried out by controlling the gas supply conditions for the organometal gases and/or the oxidizing gas to be self-controlling gas supply conditions (introducing oxygen gas first then organometal gases with separate introduction inlets) as to obtain the metal oxide dielectric film having a prescribed

composition and crystal structure (perovskite-type crystalline structure, col. 7, lines 32-42,

claims 52, 118, wherein the flow rates of organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber, col. 7, lines 7, lines 1-31,

claim 53, wherein the metal oxide dielectric film is a PZT film or a BST film, col. 6, lines 11-15 and col. 9, lines 65-68,

claim 54, wherein the substrate has capacitor electrodes formed thereon which comprises at least one of metals or metal oxides of Pt and the metal oxide dielectric film is formed on the substrate in vapor phase, col. 7, lines 25-42.

The difference between the references applied above and the instant claim(s) is: Fujii et al. teaches forming metal oxide layer with organic metal source and oxygen oxidant but does not teaches using NO_2 or ozone (O_3). However, Ui et al. teaches at col. 18, lines 18-21, using NO_2 or ozone (O_3) as oxidizing gas and organic metal gas at low vacuum pressure to form metal oxide. (meeting claims 47, 50, 119, 120).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by NO_2 or ozone (O_3) as oxidizing gas and organic metal gas as taught by Ui et al. because NO_2 or ozone (O_3) as oxidizing gas containing oxygen ions that is identical to the oxygen gas when it decomposes in the vacuum chamber. (meeting claims 47, 119, 120).

Claim 55 is rejected under 35 U.S.C 103 as being unpatentable over Fujii et al. in view of Ui et al. as applied to claims 47-49, 50-54 and 118-120 above, and further in view of Yamazaki et al. 6,979,840, newly cited.

The difference between the references applied above and the instant claim(s) is: Fujii et al. teaches forming metal oxide layer with organic metal source and oxygen oxidant but does not teaches aluminum wiring. However, Yamazaki et al. teaches at col. 4, lines 20-30, col. 12, lines 10-17, forming gate line and interconnect line with aluminum and depositing aluminum oxide with vapor phase.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming an aluminum wire on the substrate and forming aluminum oxide with vapor phase as taught by Yamazaki et al. because aluminum is a low cost and good conductor for carrying the current in the semiconductor device and a thicker aluminum oxide can be by using vapor phase deposition.

Claim 56 is rejected under 35 U.S.C 103 as being unpatentable over Fujii et al. in view of Ui et al. as applied to claims 47-49, 50-54 and 118-120 above, and further in view of Takeuchi 5,935,337, newly cited, or Yunki et al. 5,776,254, previously applied

The difference between the references applied above and the instant claim(s) is: Fujii et al. teaches forming metal oxide layer with organic metal source and oxygen oxidant but does not teaches the temperature of chamber wall. However, Takeuchi et al. teaches at col. 8, lines 40-48, forming a metal oxide film with heated chamber wall temperature at 250-260 degree C and substrate temperature at 400-700 degree C. Takeuchi et al. also teaches at col. 13, lines 4-17, col. 7, lines 54-60, fig.1, using separate inlets for metal organic gas and ozone or nitrogen oxide or oxygen oxidant gas to form a metal oxide. Yunki et al. teaches at col. 13, lines 17-27 and abstract, forming a metal oxide film with heated chamber wall. And, the specific temperature of chamber wall as claimed are taken to be obvious since these are variables of art

recognized importance which are subject to routine experimentation and optimization and discovery of an optimum value for a known process is obvious. In re Aller, 105 USPQ 233 (CCPA 1955). And, even if applicants' modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, In Re Sola 25 USPQ 433.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi or Yunki et al. because metal oxide would formed on the substrate instead of chamber walls.

Claim 121 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fujii et al. 5,006,363, previously applied, in view of Takeuchi et al. 5,935,337, newly cited.

Fujii et al. discloses a vapor phase growth method of a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

introduing metal organic material ($Sr(DPM)_2$ and $Ti(OC_3H_7)_4$, inlets 28-29) and oxidizing gas (oxygen, inlet 25) into vacuum chamber through separate introduction inlets, see fig. 2, col. 7, lines 10-30,

heating the substrate (180 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr ($5.7X10^{-4}$ torr through out the period of the film deposition), col. 7, lines 10-30,

wherein the film formation is carried out by controlling the gas supply conditions for the

organometal gases and/or the oxidizing gas to be self-controlling gas supply conditions (introducing oxygen gas first then organometal gases with separate introduction inlets)

as to obtain the metal oxide dielectric film having a prescribed composition and crystal structure (perovskite-type crystalline structure, col. 7, lines 32-42.

The difference between the references applied above and the instant claim(s) is: Fujii et al. teaches forming metal oxide layer with organic metal source and oxygen oxidant but does not teaches the temperature of chamber wall. However, Takeuchi et al. teaches at col. 8, lines 40-48, forming a metal oxide film with heated chamber wall temperature at 250-260 degree C and substrate temperature at 400-700 degree C. Takeuchi et al. also teaches at col. 13, lines 4-17, col. 7, lines 54-60, fig.1, using separate inlets for metal organic gas and ozone or nitrogen oxide or oxygen oxidant gas to form a metal oxide. And, the specific temperature of chamber wall as claimed are taken to be obvious since these are variables of art recognized importance which are subject to routine experimentation and optimization and discovery of an optimum value for a known process is obvious. In re Aller, 105 USPQ 233 (CCPA 1955). And, even if applicants' modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, In Re Sola 25 USPQ 433.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi et al. because metal oxide would formed on the substrate instead of chamber walls.

Claims 47-50, 51-54 and 118-120 are rejected under 35 U.S.C 103 as being unpatentable over Fujii et al. 5,006,363, previously cited, in view of Sandhu et al. 6,313,035, newly cited.

Fujii et al. discloses a method of forming a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

introducing metal organic material ($Sr(DPM)_2$ and $Ti(OC_3H_7)_4$, inlets 28-29) and oxidizing gas (oxygen, inlet 25, cylinder 10 at fig. 1) into vacuum chamber through separate introduction inlets, see fig. 1, 2, col. 7, lines 10-30, col. 4, lines 30-35,

heating the substrate (180 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr ($5.7X10^{-4}$ torr through out the period of the film deposition), col. 7, lines 10-30,

claims 48, 49, heating the substrate (180 °C) in the vacuum chamber,

claim 51, wherein the film formation is carried out by controlling the gas supply conditions for the organometal gases and/or the oxidizing gas to be self-controlling gas supply conditions (introducing oxygen gas first then organometal gases with separate introduction inlets) as to obtain the metal oxide dielectric film having a prescribed composition and crystal structure (perovskite-type crystalline structure, col. 7, lines 32-42,

claims 52, 118, wherein the flow rates of organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber, col. 7, lines 7, lines 1-31,

claim 53, wherein the metal oxide dielectric film is a PZT film or a BST film, col. 6, lines 11-15 and col. 9, lines 65-68,

claim 54, wherein the substrate has capacitor electrodes formed thereon which comprises at least one of metals or metal oxides of Pt and the metal oxide dielectric film is formed on the substrate in vapor phase, col. 7, lines 25-42.

The difference between the references applied above and the instant claim(s) is: Fujii et al. teaches forming metal oxide layer with organic metal source and oxygen

oxidant but does not teaches using NO_2 or ozone (O_3). However, Sandhu et al. teaches at col. 7, lines 15-55, col. 5, lines 1-67, using NO_2 or ozone (O_3) as oxidizing gas and organic metal gas at low vacuum pressure to form metal oxide. (meeting claims 47, 50, 119, 120).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by NO_2 or ozone (O_3) as oxidizing gas and organic metal gas as taught by Sandhu et al. because NO_2 or ozone (O_3) as oxidizing gas containing oxygen ions that is identical to the oxygen gas when it decomposes in the vacuum chamber. (meeting claims 47, 119, 120).

Claim 55 is rejected under 35 U.S.C 103 as being unpatentable over Fujii et al. in view of Sandhu et al. as applied to claims 47-49, 50-54 and 118-120 above, and further in view of Yamazaki et al. 6,979,840, newly cited.

The difference between the references applied above and the instant claim(s) is: Fujii et al. teaches forming metal oxide layer with organic metal source and oxygen oxidant but does not teaches aluminum wiring. However, Yamazaki et al. teaches at col. 4, lines 20-30, col. 12, lines 10-17, forming gate line and interconnect line with aluminum and depositing aluminum oxide with vapor phase.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming an aluminum wire on the substrate and forming aluminum oxide with vapor phase as taught by Yamazaki et al. because aluminum is a low cost and good conductor for carrying the current in the semiconductor device and a thicker aluminum oxide can be by using vapor phase deposition.

Claim 56 is rejected under 35 U.S.C 103 as being unpatentable over Fujii et al. in view of Sandhu et al. as applied to claims 47-49, 50-54 and 118-120 above, and further in view of Takeuchi 5,935,337, newly cited, or Yunki et al. 5,776,254, previously applied

The difference between the references applied above and the instant claim(s) is: Fujii et al. teaches forming metal oxide layer with organic metal source and oxygen oxidant but does not teaches the temperature of chamber wall. However, Takeuchi et al. teaches at col. 8, lines 40-48, forming a metal oxide film with heated chamber wall temperature at 250-260 degree C and substrate temperature at 400-700 degree C. Takeuchi et al. also teaches at col. 13, lines 4-17, col. 7, lines 54-60, fig.1, using separate inlets for metal organic gas and ozone or nitrogen oxide or oxygen oxidant gas to form a metal oxide. Yunki et al. teaches at col. 13, lines 17-27 and abstract, forming a metal oxide film with heated chamber wall. And, the specific temperature of chamber wall as claimed are taken to be obvious since these are variables of art recognized importance which are subject to routine experimentation and optimization and discovery of an optimum value for a known process is obvious. In re Aller, 105 USPQ 233 (CCPA 1955). And, even if applicants' modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, In Re Sola 25 USPQ 433.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi or Yunki et al. because metal oxide would formed on the substrate instead of chamber walls.

Claims 53-54 are rejected under 35 U.S.C 103 as being unpatentable over Ui et al. as applied to claims 47-52 and 118-120 above, and further in view of Fujii et al. 5,006,363, previously cited.

The difference between the references applied above and the instant claim(s) is: Ui et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide or ozone oxidant but does not teaches PZT or BST metal oxide film and a Pt capacitor electrode. However, Fujii et al. teaches at col. 6, lines 11-15 and col. 9, lines 65-68,, wherein the metal oxide dielectric film is a PZT film or a BST film. And, at col. 7, lines 25-42, capacitor electrodes formed thereon which comprises at least one of metals or metal oxides of Pt and the metal oxide dielectric film is formed on the substrate in vapor phase.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings by forming a PZT or BST film and a Pt capacitor electrode as taught by Fujii et al. because capacitance of a capacitor can be greatly increased by using high dielectric constant material of PZT or BST film and using Pt as capacitor electrodes so that there is no chemical reaction between PZT or BST film and capacitor electrodes.

Claim 55 is rejected under 35 U.S.C 103 as being unpatentable over Ui et al. as applied to claims 47-52 and 118-120 above, and further in view of Yamazaki et al. 6,979,840, newly cited.

The difference between the references applied above and the instant claim(s) is: Ui et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide or ozone oxidant but does not teaches aluminum wiring. However, Yamazaki et al.

teaches at col. 4, lines 20-30, col. 12, lines 10-17, forming gate line and interconnect line with aluminum and depositing aluminum oxide with vapor phase.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming an aluminum wire on the substrate and forming aluminum oxide with vapor phase as taught by Yamazaki et al. because aluminum is a low cost and good conductor for carrying the current in the semiconductor device and a thicker aluminum oxide can be by using vapor phase deposition.

Claim 56 is rejected under 35 U.S.C 103 as being unpatentable over Ui et al. as applied to claims 47-52 and 118-120 above, and further in view of Takeuchi et al. 5,935,337, newly cited, or Yunki et al. 5,776,254, previously cited

The difference between the references applied above and the instant claim(s) is: Ui et al. teaches forming metal oxide layer with organic metal source and ozone or nitrogen oxide oxidant but does not teaches the temperature of chamber wall. However, Takeuchi et al. teaches at col. 8, lines 40-48, forming a metal oxide film with heated chamber wall temperature at 250-260 degree C and substrate temperature at 400-700 degree C. Takeuchi et al. also teaches at col. 13, lines 4-17, col. 7, lines 54-60, fig.1, using separate inlets for metal organic gas and ozone or nitrogen oxide or oxygen oxidant gas to form a metal oxide. Yunki et al. teaches at col. 13, lines 17-27 and abstract, forming a metal oxide film with heated chamber wall. And, the specific temperature of chamber wall as claimed are taken to be obvious since these are variables of art recognized importance which are subject to routine experimentation and optimization and discovery of an optimum value for a known process is obvious. In re Aller, 105 USPQ 233 (CCPA 1955). And, even if applicants' modification results in

great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, In Re Sola 25 USPQ 433.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi and Yunki et al. because metal oxide would formed on the substrate instead of chamber walls.

Claim 121 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ui et al. 5.976,992, in view of Takeuchi et al. 5,935,337, newly cited.

Ui et al. discloses a vapor phase growth method of a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

Ui et al. discloses a method of forming a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

introducing metal organic material through, inlet 11 and **oxidizing gas** NO_2 or ozone (O_3) or oxygen through 10b into vacuum chamber of separate introduction inlets, see fig. 2-21, col. 14, Lines 15-67, col. 18, lines 18-21,

heating the substrate (250-350°C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr ($1X10^{-3}$ torr – 2 torr at reaction chamber and reaction zone can be at preferred range 0.01 torr – 1 torr, col. 9, lines 51-55, such as reaction zone 63 at 0.01 torr, see col. 15, line20), col. 4, lines 43-46,

wherein the film formation is carried out by controlling the gas supply conditions for the organometal gases and/or the oxidizing gas to be self-controlling gas supply

conditions (introducing oxygen gas first then organometal gases with separate introduction inlets) as to obtain the metal oxide dielectric film having a prescribed composition and crystal structure, see abstract,

wherein the flow rates of organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber, figs. 2-21.

The difference between the references applied above and the instant claim(s) is: Ui et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide or ozone oxidant but does not teaches the temperature of chamber wall. However, Takeuchi et al. teaches at col. 8, lines 40-48, forming a metal oxide film with heated chamber wall temperature at 250-260 degree C and substrate temperature at 400-700 degree C. Takeuchi et al. also teaches at col. 13, lines 4-17, col. 7, lines 54-60, fig.1, using separate inlets for metal organic gas and ozone or nitrogen oxide or oxygen oxidant gas to form a metal oxide. And, the specific temperature of chamber wall as claimed are taken to be obvious since these are variables of art recognized importance which are subject to routine experimentation and optimization and discovery of an optimum value for a known process is obvious. In re Aller, 105 USPQ 233 (CCPA 1955). And, even if applicants' modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, In Re Sola 25 USPQ 433.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi et al. because metal oxide would formed on the substrate instead of chamber walls.

Claims 53-54 are rejected under 35 U.S.C 103 as being unpatentable over Allman et al. as applied to claims 47-52 and 118-120 above, and further in view of Fujii et al. 5,006,363, previously cited.

The difference between the references applied above and the instant claim(s) is: Allman et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide oxidant but does not teaches PZT or BST metal oxide film and a Pt capacitor electrode. However, Fujii et al. teaches at col. 6, lines 11-15 and col. 9, lines 65-68,, wherein the metal oxide dielectric film is a PZT film or a BST film. And, at col. 7, lines 25-42, capacitor electrodes formed thereon which comprises at least one of metals or metal oxides of Pt and the metal oxide dielectric film is formed on the substrate in vapor phase.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings by forming a PZT or BST film and a Pt capacitor electrode as taught by Fujii et al. because capacitance of a capacitor can be greatly increased by using high dielectric constant material of PZT or BST film and using Pt as capacitor electrodes so that there is no chemical reaction between PZT or BST film and capacitor electrodes.

Claim 55 is rejected under 35 U.S.C 103 as being unpatentable over Allman et al. as applied to claims 47-52 and 118-120 above, and further in view of Yamazaki et al. 6,979,840, newly cited.

The difference between the references applied above and the instant claim(s) is: Allman et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide oxidant on aluminum wiring but does not teaches aluminum oxide. However,

Yamazaki et al. teaches at col. 4, lines 20-30, col. 12, lines 10-17, forming gate line and interconnect line with aluminum and depositing aluminum oxide with vapor phase.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming an aluminum wire on the substrate and forming aluminum oxide with vapor phase as taught by Yamazaki et al. because aluminum is a low cost and good conductor for carrying the current in the semiconductor device and a thicker aluminum oxide can be by using vapor phase deposition.

Claim 56 is rejected under 35 U.S.C 103 as being unpatentable over Allman et al. as applied to claims 47-52 and 118-120 above, and further in view of Takeuchi et al. 5,935,337, newly cited, or Yunki et al. 5,776,254, previously cited.

The difference between the references applied above and the instant claim(s) is: Allman et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide oxidant but does not teaches the temperature of chamber wall. However, Takeuchi et al. teaches at col. 8, lines 40-48, forming a metal oxide film with heated chamber wall temperature at 250-260 degree C and substrate temperature at 400-700 degree C. Takeuchi et al. also teaches at col. 13, lines 4-17, col. 7, lines 54-60, fig.1, using separate inlets for metal organic gas and ozone or nitrogen oxide or oxygen oxidant gas to form a metal oxide. Yunki et al. teaches at col. 13, lines 17-27 and abstract, forming a metal oxide film with heated chamber wall. And, the specific temperature of chamber wall as claimed are taken to be obvious since these are variables of art recognized importance which are subject to routine experimentation and optimization and discovery of an optimum value for a known process is obvious. In re Aller, 105 USPQ 233 (CCPA 1955). And, even if applicants' modification results in

great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, In Re Sola 25 USPQ 433.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi and Yunki et al. because metal oxide would formed on the substrate instead of chamber walls.

Claim 121 is rejected under 35 U.S.C. 103(a) as being unpatentable over Allman et al. 6,313,035, in view of Takeuchi et al. 5,935,337, newly cited.

Allman et al. discloses a vapor phase growth method of a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:
introducing metal organic material through, inlet 17, 19, 21 and **oxidizing gas** NO_2 or oxygen through one of inlets 17, 19 or 21 into vacuum chamber of separate introduction inlets, see fig. 1, col. 6, lines 1-67, col. 7, lines 1-5,

heating the substrate (100-900 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr (10 microTorr – 1 atm for deposition condition at reaction chamber after introducing source and oxidizing gases), see col. 6, line 60-67, col. 7, lines 1-5, (meeting claims 47, 119, 120),

oxidizing gas is NO_2 , col. 6, lines 1-67, col. 7, lines 1-5,

wherein the film formation is carried out by controlling the gas supply conditions for the organometal gases and/or the oxidizing gas to be self-controlling gas supply conditions (introducing oxygen gas first then organometal gases with separate

introduction inlets) as to obtain the metal oxide dielectric film having a prescribed composition and crystal structure, see abstract,

wherein the flow rates of organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber, fig. 1.

The difference between the references applied above and the instant claim(s) is: Allman et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide oxidant but does not teaches the temperature of chamber wall. However, Takeuchi et al. teaches at col. 8, lines 40-48, forming a metal oxide film with heated chamber wall temperature at 250-260 degree C and substrate temperature at 400-700 degree C. Takeuchi et al. also teaches at col. 13, lines 4-17, col. 7, lines 54-60, fig.1, using separate inlets for metal organic gas and ozone or nitrogen oxide or oxygen oxidant gas to form a metal oxide. And, the specific temperature of chamber wall as claimed are taken to be obvious since these are variables of art recognized importance which are subject to routine experimentation and optimization and discovery of an optimum value for a known process is obvious. In re Aller, 105 USPQ 233 (CCPA 1955). And, even if applicants' modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, In Re Sola 25 USPQ 433.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi et al. because metal oxide would formed on the substrate instead of chamber walls.

Claims 47-54 and 118-120 are rejected under 35 U.S.C 103 as being unpatentable over Sandhu et al., 6,313,035, newly cited, in view of Fujii et al. 5,006,363, previously cited.

Sandhu et al. discloses a method of forming a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

introducing metal organic material through, inlet 14 and **oxidizing gas** NO_2 or ozone (O_3) or oxygen through 19 into vacuum chamber of separate introduction inlets, see fig. 1, col. 7, Lines 15-55, col. 5, lines 1-67,

heating the substrate (100-600 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr (150 mtorr – 100 torr for deposition condition at reaction chamber, see col. 6, line 55-63, (meeting claims 47, 119, 120),

claims 48, 49, heating the substrate (100-600 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr (150 mtorr – 100 torr for deposition condition at reaction chamber, see col. 6, line 55-63, (meeting claims 47, 119, 120),

claim 50, oxidizing gas is NO_2 or ozone (O_3), col. 7, Lines 15-55, col. 5, lines 1-67,

claim 51, wherein the film formation is carried out by controlling the gas supply conditions for the organometal gases and/or the oxidizing gas to be self-controlling gas supply conditions (introducing oxygen gas first then organometal gases with separate introduction inlets) as to obtain the metal oxide dielectric film having a prescribed composition and crystal structure, see abstract,

claims 52, 118, 119, wherein the flow rates of organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber, fig. 1.

The difference between the references applied above and the instant claim(s) is: Sandhu et al. teaches forming metal oxide layer with organic metal source and NO_2 or ozone (O_3) oxidant at vacuum total pressure of 150 mtorr but does not teaches the vacuum pressure lower than $1X10^{-2}$ torr, forming PZT or BST metal oxide film and a Pt capacitor electrode. . However, Fujii et al. teaches at col. 7, lines 10-30, keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr ($5.7X10^{-4}$ torr through out the period of the film deposition), (meeting claims 47, 119, 120). And, Fujii et al. teaches at col. 6, lines 11-15 and col. 9, lines 65-68,, wherein the metal oxide dielectric film is a PZT film or a BST film. And, at col. 7, lines 25-42, capacitor electrodes formed thereon which comprises at least one of metals or metal oxides of Pt and the metal oxide dielectric film is formed on the substrate in vapor phase.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film at vacuum total pressure less than $1X10^{-2}$ torr as taught by Fujii et al. because lowering the vacuum pressure would form a denser metal oxide. And, Sandhu teaches forming metal oxide at **about** 150 mtorr (1.5×10^{-1}) clearly meet the limitation of $1X10^{-2}$ torr because **about** is not an exact and precise pressure as long as pressure near 1.5×10^{-1} torr would meet the limitation of $1X10^{-2}$ torr. And in such low vacuum pressure 1.5×10^{-1} is not much difference from $1X10^{-2}$ torr because it is difficult to obtain an accurate measurement in such low vacuum pressure. (meeting claims 47, 119, 120).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings by forming a PZT or BST

film and a Pt capacitor electrode as taught by Fujii et al. because capacitance of a capacitor can be greatly increased by using high dielectric constant material of PZT or BST film and using Pt as capacitor electrodes so that there is no chemical reaction between PZT or BST film and capacitor electrodes, (meeting claims 53-54).

Claim 55 is rejected under 35 U.S.C 103 as being unpatentable over Sandhu et al. in view of Fujii et al. as applied to claims 47-52 and 118-120 above, and further in view of Yamazaki et al. 6,979,840, newly cited.

The difference between the references applied above and the instant claim(s) is: Sandhu et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide or ozone oxidant but does not teaches aluminum wiring. However, Yamazaki et al. teaches at col. 4, lines 20-30, col. 12, lines 10-17, forming gate line and interconnect line with aluminum and depositing aluminum oxide with vapor phase.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming an aluminum wire on the substrate and forming aluminum oxide with vapor phase as taught by Yamazaki et al. because aluminum is a low cost and good conductor for carrying the current in the semiconductor device and a thicker aluminum oxide can be by using vapor phase deposition.

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi and Yunki et al. because metal oxide would formed on the substrate instead of chamber walls.

Claim 121 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sandhu et al. 6,313,035, newly cited, in view of Fujii et al., previously cited, and Takeuchi et al. 5,935,337, newly cited.

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Sandhu et al. discloses a method of forming a metal oxide layer the semiconductor substrate by a thermal CVD method, which includes:

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heating the substrate (100-600 °C) in the vacuum chamber and keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr (150 mtorr – 100 torr for deposition condition at reaction chamber, see col. 6, line 55-63),

wherein the film formation is carried out by controlling the gas supply conditions for the organometal gases and/or the oxidizing gas to be self-controlling gas supply conditions (introducing oxygen gas first then organometal gases with separate introduction inlets) as to obtain the metal oxide dielectric film having a prescribed composition and crystal structure, see abstract,

wherein the flow rates of organometal gases and the oxidizing gas are directly controlled without using a carrier gas to introduce the organometal gases and the oxidizing gas into the vacuum chamber, fig. 1.

The difference between the references applied above and the instant claim(s) is: Sandhu et al. teaches forming metal oxide layer with organic metal source and nitrogen oxide or ozone oxidant but does not teaches vacuum pressure at $1X10^{-2}$ torr and the temperature of chamber wall. However, Fujii et al. teaches at col. 7, lines 10-30, keeping the total pressure of the vacuum chamber at less than < $1X10^{-2}$ torr ($5.7X10^{-4}$ torr through out the period of the film deposition). And, Takeuchi et al. teaches at col. 8, lines 40-48, forming a metal oxide film with heated chamber wall temperature at 250-

260 degree C and substrate temperature at 400-700 degree C. Takeuchi et al. also teaches at col. 13, lines 4-17, col. 7, lines 54-60, fig.1, using separate inlets for metal organic gas and ozone or nitrogen oxide or oxygen oxidant gas to form a metal oxide. And, the specific temperature of chamber wall as claimed are taken to be obvious since these are variables of art recognized importance which are subject to routine experimentation and optimization and discovery of an optimum value for a known process is obvious. In re Aller, 105 USPQ 233 (CCPA 1955). And, even if applicants' modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art, In Re Sola 25 USPQ 433.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film at vacuum total pressure less than $1X10^{-2}$ torr as taught by Fujii et al. because lowering the vacuum pressure would form a denser metal oxide. And, Sandhu teaches forming metal oxide at **about** 150 mtorr (1.5×10^{-1}) clearly meet the limitation of $1X10^{-2}$ torr because **about** is not an exact and precise pressure as long as pressure near 1.5×10^{-1} torr would meet the limitation of $1X10^{-2}$ torr. And in such low vacuum pressure 1.5×10^{-1} is not much difference from $1X10^{-2}$ torr because it is difficult to obtain an accurate measurement in such low vacuum pressure.

And, It would also have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings forming a metal oxide film by heating the chamber wall with specific temperature as taught by Takeuchi et al. because metal oxide would formed on the substrate instead of chamber walls.

Conclusion

Applicant's arguments filed Aug. 9, 2006 have been fully considered but they are not persuasive. Because claim 47 includes only nitrogen dioxide ***or*** ozone, hence, when claim 47 is read as including nitrogen dioxide only, then claim 50 is not further limiting the subject matter of claim 47. Nitrogen dioxide and ozone gases become oxygen ions in the reaction chamber, hence it is obvious that using nitrogen oxide gas or ozone gas as oxidant has no difference from using oxygen gas. And, newly cited references teach using nitrogen oxide gas or ozone gas or oxygen gas as oxidant as set forth above.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to H. Jey Tsai whose telephone number is (571) 272-1684. The examiner can normally be reached on from 7:00 Am to 4:00 Pm., Monday thru Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873. The fax phone number for this Group is (703) 872-9306.

hjt

10/12/2006

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